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THICKSPIKE WHEATGRASS PERFORMANCE IN TRIALS CONDUCTED 1977-1992 BY THE PULLMAN PLANT MATERIALS CENTER.

by

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Introduction

Thickspike wheatgrass (*Elymus lanceolatus* Scrib. & Smith ssp. *lanceolatus*) is a native rhizomatous wheatgrass indigenous to much of the western United States. It is a common range grass on sand, loamy sand, and sandy loam soils in areas receiving 6-20 inches of annual precipitation (SCS-WA 1972, MSU 1990). It occurs less commonly on silt loam and granular clay soils. Thickspike wheatgrass may be found growing in Washington at elevations between 300 and 2000 feet (SCS-WA 1972). Thickspike wheatgrass is similar in appearance to western wheatgrass (*Pascopyrum smithii* Love [*Agropyron smithii*]) and slender wheatgrass (*Elymus trachycaulus* Gould ex Shinners ssp. *trachycaulus* [*Agropyron trachycaulus*]).

Various parameters have been evaluated over the years and results of a few studies have shown that:

1. **Thickspike wheatgrass exhibited high seedling vigor and established very quickly in semiarid environments.**

2. **Thickspike wheatgrass developed excellent ground cover in the first few years after seeding.**

3. **Thickspike wheatgrass groundcover diminished soon after it dominated a site.**

4. **Local ecotypes performed better in Washington trials than ecotypes originating east of the Rockies.**

The first thickspike wheatgrass release was made in 1971 by the Bridger, Montana Plant Materials Center and was named 'Critana'. The Pullman Plant Materials Center began evaluating strains of thickspike wheatgrass as early as 1939 and identified a strain with superior characteristics, 'P-1822'. 'P-1822', later accessioned as 'T-6633', was collected near The Dalles, Oregon on windblown sands along the Columbia River.

New Nomenclature and Genetics

Thickspike wheatgrass was classified as *Agropyron dasystachyum* Scrib. for many years but recent research conducted by the USDA-ARS Forage and Range Research Laboratory in Logan, Utah and Utah State University has resulted in a reclassification. Thickspike wheatgrass is currently classified as *Elymus lanceolatus* Scrib. & Smith ssp. *lanceolatus* (Barkworth and Dewey 1985). Chromosome analysis has shown that thickspike wheatgrass exhibits the *Elymus* "SSHH" genome which prompted the name change. Thickspike wheatgrass is cross pollinated which is uncommon in the *Elymus* genus (Dewey 1984). Hybridization with western or slender wheatgrass is minimal. Western wheatgrass flowers later in the season than thickspike wheatgrass and induced crosses between the two species result in almost entirely nonviable seed. Slender wheatgrass is predominantly self pollinated which greatly limits natural crossing with thickspike wheatgrass.

Seedling Vigor and Establishment

Seed of thickspike wheatgrass is large, 145,000 - 156,000 seeds per pound, awnless, and lemmas may be slightly pubescent. Dormancy has not been expressed in greenhouse emergence trials and emergence normally occurred within six days of water imbibition. Excellent emergence occurred at a depth of 1/2" and limited emergence, approximately 15%, occurred at 2" using a 1:1:1 potting-mix of peat, perlite, and vermiculite in a greenhouse study. Clearly, seedling vigor is quite high since it can emerge from great depths (Johnson and Asay, 1987).

Ground Cover and Interspecies Competition Trial: Study 1-76.

This study was seeded in 1977 at the Lind Dry Land Research Unit to evaluate adaptation and simple interspecies competition reactions of various grasses and a legume. This study was conducted on a silt loam soil and a mean annual precipitation of 9.25-inches. Seven grasses including 'P-1822' thickspike wheatgrass were seeded alone and with each of 12 other species/cultivars and periodically evaluated for fourteen years.

'P-1822' thickspike wheatgrass was very quick to establish with only 'Sodar' streambank wheatgrass (*Elymus lanceolatus* Scrib. & Smith ssp. *lanceolatus* [*Agropyron riparium*]) providing more ground cover the establishment year ('Sodar' data not shown). Where seeded alone, thickspike wheatgrass provided 65% ground cover one year after seeding but thickspike wheatgrass ground cover was reduced substantially when seeded with another species (Table 1).

Thickspike wheatgrass provided an average ground cover of 52% after two years and appeared to be well adapted to the environmental conditions of the area. However, ground cover decreased after the second year and thickspike wheatgrass was displaced by other species. Only trace

amounts of thickspike wheatgrass were observed in year 11 and average ground cover fourteen years after seeding was only 4% (Table 1).

Seedling Establishment and Ground Cover Trials: Study 2-77A

This study was initiated in 1977 at the Lind Dry Land Research Unit and the Central Ferry Western Regional Plant Introduction Station to evaluate plant establishment techniques and long-term adaptation of several dryland grasses. Plantings were made for three consecutive years, both fall and spring, and plots were drill and broadcast seeded. Central Ferry Station receives more precipitation than Lind, approximately 13-inches annually, and the soils are glacial outwash silt loams. Fall seeding was much more successful than spring seeding at both locations (Table 2). Spring seedbed preparation dried the soil surface which greatly reduced plant densities.

Table 1. Percent ground cover of 'P-1822' thickspike wheatgrass when seeded with each of twelve other species.

		---------- Thickspike Cover ----------			
Species	Cultivar	Year 1	Year 2	Year 11	Year 14
			(percent)		
Check (ie. thickspike alone)	**----**	**65**	**80**	**2**	**8**
Alfalfa	Ladak	28*[1/]	43*	0	0*
Intermediate Wheatgrass	Greenar	38*	50	2	5
Big Bluegrass	Sherman	42*	42*	2	15*
Basin Wildrye	Magnar	53	75	3	0*
Crested Wheatgrass	Nordan	33*	40*	0	2
Siberian Wheatgrass	P-27	47*	57	2	3
Tall Wheatgrass	Alkar	45*	68	2	0*
Pubescent Wheatgrass	Luna	35*	50	0	2
Pubescent Wheatgrass	Topar	33*	45*	3	12
Bluebunch Wheatgrass	Secar	37*	40*	0	2
Beardless Wheatgrass	Whitmar	35*	40*	2	5
Russian Wildrye	P-210	38*	48	0	3
Mean		41	52	1	4

[1/] Percentages followed within a column by an asterisk (*) are significantly less than the ground cover of thickspike seeded alone as determined by the Fischer's protected LSD test at the 5% level of confidence.

Table 2. Comparison of fall seeding to spring seeding of thickspike wheatgrass at two semiarid sites in Washington.

Location	Fall Seeded	Spring Seeded
	(Plants m^2)	
Central Ferry	118	22
Lind	90	11

Broadcast seeding developed ground cover similar to drill seedings (Table 3). Harrowing as a last seedbed preparation operation left many small ridges which after weathering, produced a thin soil covering over the broadcast seed. Broadcast seeding onto undisturbed soil would most probably provide contrary results. Ground cover peaked two to three years following seeding and dropped (Table 4). The plant community in thickspike wheatgrass plots fourteen years after seeding included remnant plants of thickspike wheatgrass interspersed within cheatgrass *(Bromus tectorum* L.), sheep fescue (*Festuca ovina* L.), and bluebunch wheatgrass (*Pseudorogneria spicata* Love ssp. *spicata* [*Agropyron spicatum*]). Interestingly enough, cheatgrass did not occur in any of the plots of other perennial grass mixtures. This study was conducted on silt loam soils which are not an optimal environment for thickspike wheatgrass. Loss of ground cover and rapid invasion by other species may be due to poor compatibility of thickspike wheatgrass to fine-textured soil.

Table 3. First year ground cover of 'P-1822' thickspike wheatgrass as a result of drill or broadcast seeding method.

Location & Seeding Date	Drill	Broadcast	Difference
		(percent)	
Central Ferry, Fall Seeded	84	83	1
Central Ferry, Spring Seeded	40	26	14
Lind, Fall Seeded	51	46	5
Lind, Spring Seeded	14	15	1

Table 4. Ground cover provided by three dryland grasses seeded alone or with an "understory" grass at Central Ferry and Lind, Washington. Seedings were made via broadcasting in 1997 and monitored periodically for 14 years.

	--------Centeral Ferry--------				----------Lind----------			
Species	Year 1	Year 2	Year 9	Year 14	Year 1	Year 2	Year 9	Year 14
				(% Ground Cover)				
Thickspike wheatgrass	**55**	**80**	**10**	**20**	**31**	**50**	**36**	**39**
Crested Wheatgrass	50*[1]	74*	30*	18	28	50	52*	64*
Crested Wheatgrass + Sheep Fescue	50*	81	87*	89*	26	50	55*	70*
Crested Wheatgrass + Canby Bluegrass	47*	75*	49*	28*	27	48	56*	74*
Bluebunch Wheatgrass	51	80	65*	61*	27	46	55*	66*
Bluebunch Wheatgrass	54	87*	91*	93*	27	47	60*	63*

+ Sheep Fescue								
Bluebunch Wheatgrass + Canby Bluegrass	53	80	65*	59*	27	46	59*	68*
Mean	51	80	57	53	28	48	52	63

1/ Ground cover percentages within a column followed by an asterisk (*) are significantly different from the thickspike wheatgrass ground cover as determined by the Fischer's protected LSD test at the 5% level of confidence.

Comparison of Thickspike Wheatgrass Ecotypes for Ground Cover and Seed & Biomass Production: Studies 2-77J3 & 2-77J4

Two recent studies compared several thickspike wheatgrass accessions at three sites in Washington: the Lind Dry Land Research Unit, Central Ferry Plant Introduction Station, and at the Gary Maughan ranch located west of Othello on Saddle Mountain. The Saddle Mountain site is of particular interest because the annual precipitation is less than 8" and the soil is a loamy sand. Seventy percent ground cover was achieved in one plot of 'P-1822' thickspike wheatgrass in 1992. However, ground cover of 'P-1822' was not as high in the other replications. Sand deposition is a favorable environment for thickspike wheatgrass (SCS-WA 1972) and this plot is on the downwind side of the study where deposition occurs.

Biomass production of three and four year old stands of thickspike wheatgrass was measured in 1992, a very dry year (Table 5). 'Critana' and 'PI-236663' originated east of the Rocky Mountains and did not produce as well as the accessions originating from the intermountain region. Biomass production of thickspike wheatgrass varies with the age of the stand. Maximum production typically occurs within 3-4 years of seeding and decreases considerably after maximum production is achieved. A study conducted in southwestern Montana showed a three year old stand of 'Critana' thickspike wheatgrass producing 1848 lb/acre and only 246 lb/acre five years later (SCS-MT 1988).

Table 5. Biomass production of four accessions of thickspike wheatgrass sampled at three semiarid sites in 1992.

Accession	Central Ferry1/	Lind2/	Saddle Mountain1/	Mean
		(lbs/acre)		
P-1822	1103	1151	564	935
T-21076	480	1271	828	864
Critana	864	360	252	540
PI-236663	1049	90	28	389
Mean	874	718	418	

1/ Four year old stand

2/ Three year old stand

Leaf heights measured at Lind in 1992 of 'P-1822', 'T-21076', 9033814, and 'Critana' thickspike wheatgrasses were 15, 15, 14, and 9-inches, respectively. Culm heights of 'P-1822', 'T-21076', 9033814, and 'Critana' were 33, 37, 32, and 23-inches, respectively. Biomass production was greatest for 9033814, a synthetic of 'P-1822' and 'T-21076', in this trial. Its greater biomass was a result of thicker stands since leaf and culm heights were less than either parent.

Conclusions

Thickspike wheatgrass exhibited high seedling vigor and rapidly colonized bare ground. Peak ground cover typically occurred within 4 years of seeding but diminished rapidly. As cover diminished, thickspike was displaced by other species such as cheatgrass, 'Secar' bluebunch wheatgrass, 'Covar' sheep fescue and 'Sherman' big bluegrass (*Poa secunda* Presl. [*Poa ampla*]). We do not know if these species are simply replacing voids created by the loss of thickspike or if they are actively out-competing thickspike. A few remnant plants of thickspike wheatgrass have persisted fifteen years which indicate that this species is not short-lived. Thickspike wheatgrass biomass production followed the same pattern as ground cover.

Thickspike wheatgrass provides outstanding initial ground cover but should not be seeded alone in semiarid portions of Washington. Persistent drought tolerant species should be seeded with thickspike wheatgrass in these situations.

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